

本邦産 *Endothia* 属菌について—I

本邦産 *Endothia* 属菌の種類

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ま え が き

いままでに記載されている *Endothia* 属菌には、クリの胴枯病菌 *Endothia parasitica* (MURR.) P. et H. W. ANDERSON をふくめて8種がある。しかし、わが国ではこの属に関する報文はすくなく、原が *Endothia* 属菌の1種^{*1}を、南部、卜蔵、辻が *Endothia parasitica* を報告したのにつづいて、北島の報告があるのみである。北島はわが国に産する *Endothia parasitica* およびその類似菌の病原性、生理的諸性質などの比較研究をおこなったが、類似菌の種名は同定しないまま、かりに *Endothia* B および *Endothia* C とするにとどめている。

著者らはここ数年来、*Endothia parasitica* をとりあつかうかたわら、そのほかの *Endothia* 属菌の採集にもあたつてきたが、現在までに新種2菌をふくめて7種の菌を採集しているので、以下に著者らの採集した菌をいままでの記載とくらべながらかんたんにのべる。

Endothia 属の特徴および検索表

Endothia 属は 1849 年に FRIES が *Sphaeria* 属から分けてあたらしくもうけた属であるが、彼の記載はきわめてかんたんなものであつた。くわえて、そのごながいいいだ、この属の菌の2、3の種のあいだに複雑な種名の混乱がくりかえされていたが、1917 年 SHEAR らはくわしい研究と調査の結果、その混乱を整理して *Endothia* 属のモノグラフを発表し、それとともにこの属の特徴のくわしい記載をおこなつた。

Endothia 属の特徴は、子座がよく発達し、柄子殻、子のう殻とも子座の内部につくられることと、子座が鮮明な黄色、橙黄色、橙色、橙紅色を呈することであるが、その一般的な形態をのべると次のとおりである。

Endothia 属 (E. FRIES, 1849)

子座は枝または幹に生じ、はじめ樹皮下に生ずるがのち表皮を破り疣状ないし半球状の隆起となる。その形、大きさにはかなりの変異がある。散生、群生または列生(寄主、樹皮の状態によりことなる。クリ、ミヅナラなどの樹皮にわれ目のおおい樹種ではわれ目に列生することがおおい)。子座の表面は黄色、橙黄色、橙色、橙紅色を呈し、内部は鮮黄色ないし緋色を呈する。子囊殻および柄子殻は子座の内部に生ずる。子囊殻は子座の底部に1～数層に不規則にならんで生じ、成熟すれば黒い殻壁をつくり子座をつぎぬけて表面に乳頭状に孔口をひらく長い頸をもつ。子囊はこん棒状、長楕円形ないし長紡錘形、なかに8

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個の子嚢胞子をふくむ。子嚢胞子は円筒形、楕円形、紡錘形あるいは新月形に彎曲する。単胞（時に偽隔膜をつくる）または2胞で無色ないし淡黄色。ふつう側糸をもたない。柄子殻は樹皮の下にできる場合には子座のなかに1～数個の不規則形の小室として生じ、露出した材の表面に生ずる場合には子座をとともなわず、球形で裸生する。柄胞子は単胞、円筒形ないし腸詰形、塊では淡黄色ないし淡褐色。

Endothia 属菌の寄主はおもに穀斗科の植物（ナラ類、クリ、ブナなど）であるが、穀斗科のほかにはカエデ類、シデ類、ウルシ類、クルミ類に寄主をもつ種（*E. parasitica*, *E. fluens*）もある。また穀斗科には発見されずユーカリ類やマンゴーを寄主とする種（*E. havanensis*）、あるいは *Coccolobis*（タデ科、中南米産果樹）の果実に発見された種（*E. Coccolobii*）もある。

Endothia 属菌のなかではクリに激しい病原性をもつ *E. parasitica* をのぞいて、ほかの種はほとんど病原性をもたないかあつてもきわめて弱いようである。*E. parasitica* においても、クリ以外の寄主にたいしては病原性は弱い。

SHEAR らは 1917 年に発表した報告において *Endothia* 属菌を整理し1新種をくわえて6種としたが、そのご BRUNER, VIZIOLII によつてそれぞれ新種が記載され、また著者らもまえにのべたように2種の新種をえているので、現在 *Endothia* 属菌は10種になった。これらの種の検索表をつぎに示す。

Endothia 属菌の検索表

1. 子嚢胞子は単胞。

- A. 子嚢殻はふつう1子座内に100以上生ずる。子嚢は $18\sim 35\times 3\sim 5.5\mu$ 。子嚢胞子は新月形、 $(5.5-7)\sim 10(-11)\times (0.7-1.5)\sim 2.5(-3)\mu$ 。.....*E. singularis*
- B. 子嚢殻は1子座内に25～50個を生ず。子嚢は $25\sim 30\times 6\sim 7\mu$ 。子嚢胞子は円筒形または彎曲する。時に偽隔膜を生ずる。 $(7-7.5)\sim 10(-11)\times 2\sim 2.5(-3)\mu$ 。.....(*E. gyrosa*)*¹

2. 子嚢胞子は2胞。子嚢殻の頂端に2つの粒状物をもつ。

A. 子嚢胞子は隔膜部でくびれない。

- a. 子嚢は $25\sim 35\times 5\sim 7\mu$ 。子嚢胞子は $(6-7)\sim 7.5(-8.5)\times 3\sim 3.5(-4)\mu$ 。.....(*E. longirostris*)
- b. 子嚢殻は1子座内に2～5個を生ず。子嚢は $30\sim 40\times 4\sim 6\mu$ 。子嚢胞子は $5.5\sim 8\times 1.8\sim 2.7\mu$ 。*Coccolobis* のみに記録されている。.....(*E. Coccolobii*)
- c. 子嚢殻は1子座内に10～25個を生ず。子嚢は $30\sim 40\times 5.5\sim 8\mu$ 。子嚢胞子は $(6-9)\sim 3.5\sim 9(-10)\times (2.5-3)\sim 4(-4.5)\mu$ 。.....*E. fluens*
- d. 子嚢殻は1子座にふつう20個内外。子嚢は $40\sim 53\times 5.5\sim 8.5\mu$ 。子嚢胞子は $(7.5-11)\sim 12.5(-12.5)\times (3-4)\sim 4.5(-5)\mu$ 。.....*E. tropicalis*

B. 子嚢胞子は隔膜部でくびれる。

- a. 子座はほとんど表生にちかく、子嚢殻は1子座に10個内外生ずる。子嚢は $33\sim 52\times 5\sim 7.5\mu$ 。子嚢胞子は $7.5\sim 11\times 3\sim 4\mu$ 。ユーカリ、マンゴーのみに記録されている。.....*E. havanensis*
- b. クリに激しい病原性を持ち、樹皮下に白色ないし淡黄色の扇状菌糸を生ずる。子嚢殻は1子座

*¹ カツコした種はまだ日本で採集されないもの。

- に 20~50 個を生ずる。子嚢は $(30-40-50)(-60) \times (5-6-8)(-9) \mu$ 。子嚢胞子は $7-9(-13) \times (3-3.5-4.5)(-5) \mu$ 。..... *E. parasitica*
- c. 子嚢殻は 1 子座に 50 個内外を生ずる。子嚢は $43-66 \times 7-11 \mu$ 。子嚢胞子は $(9-10.5-12.5)(-17) \times (3.5-4-4.5)(-5.5) \mu$ 。..... *E. japonica*
- d. 子嚢殻は 1 子座にふつう 50 個を生ずる。子嚢は $62-73 \times 10-11 \mu$ 。子嚢胞子は $14-18 \times 5-5.5 \mu$ 。..... *E. macrospora*

わが国で採集された *Endothia* 属菌

1. *Endothia singularis* (P. et H. SYDOW) SHEAR et STEVENS (Text-fig. 1, Plate 1: A, B)

子座は樹皮に生じ、散生または群生、表面は暗橙黄色ないし濃橙黄色 (Cadmium Orange*1~Carmin または Naple Red)。子嚢殻は数個~百数十個、ふつう 100 個内外が子座の底部に不規則に数層をなしてならび、球形部の直径は 200~350 μ 。子座の表面に孔口をひらく黒く長い頸をもち、その長さは 240~1010 μ 。子嚢はこん棒状ないし紡錘形でやや一方にまがり、大きさ $18-31 \times 3-5.5 \mu$ 。子嚢胞子は新月形または円筒形で両端がややまるく、無色、単胞で子嚢のなかに 8 個が不整にならぶ。大きさは $5.5-11 \times 0.7-1.7 \mu$ ふう 7~10 $\times 1.5 \mu$ 。扇状菌糸は生じない。

SHEAR らの記載をみると、この菌の子嚢および子嚢胞子の大きさはそれぞれ $25-35 \times 4.5-5.5 \mu$, $7-11 \times 1.5-3 \mu$ であり、著者らの子嚢および子嚢胞子よりもやや大きい、他の特徴が一致するので *Endothia singularis* と同定する。本菌の採集資料は Table 1 にしめたがコナラ、シイおよびクヌギはこの菌のあたらしい寄主である。ジャガイモ寒天培養基上において菌はほぼたいらに發育し、約 1 カ月ののちには菌叢は橙黄色 (Mikado Orange) を呈し、菌叢上には 2, 3 の大きい柄子殻を形成、それから淡黄色ないし濃黄褐色 (Salmon Orange~Brazil Red) の粘質の柄胞子塊をおしだす。

2. *Endothia fluens* (SCHW.) SHEAR et STEVENS (Text-fig. 2, Plate 1: C, D; Plate 2: A, B)

子座は樹皮に生じ、散生または群生、表面黄褐色 (Cadmium Yellow~Cadmium Orange)。柄子殻は子座の内部に単一の、あるいは数個の不規則形の小室として生ずる。また、しばしば材のうえにも生ずるが、その際には柄子殻子座をとみなわず、一室で小さい。柄胞子は短桿形、単胞、無色。粘質をおびその塊は淡黄色ないし橙黄色。大きさ $4 \times 1-1.5 \mu$ 。子嚢殻はふつう 10~25 個が不規則にかたまつて子座の底部に生ずる。球形部の直径は 240~350 μ 。子座の表面に孔口をひらく黒色の頸をもち、その長さは 240~320 μ 。子嚢はこん棒状または紡錘形、無色、大きさ $30-40 \times 5.5-7 \mu$ 。子嚢胞子は橢円形ないし円筒形で両端はまるく、無色、2 胞、隔膜部ではくびれない。子嚢のなかに 8 胞子が不規則に 1~2 列にならぶ。大きさ $6.5-8.5 \times 2.5-3.2 \mu$ 。扇状菌糸は生じない。

SHEAR らの記載によれば *Endothia fluens* は子嚢が $30-40 \times 6-8 \mu$ 、子嚢胞子が $6-10 \times 3-4.5 \mu$ 、ふう $6.5-9 \times 3-4 \mu$ の大きさであり、著者らの菌はやや子嚢胞子の幅がせまい点をのぞいてはその記載にきわめてよく一致する。本菌の採集資料を Table 2 にしめたがブナ、コナラおよびアベマキはこの菌のあたらしい寄主である。ジャガイモ寒天培養基に約 1 カ月この菌叢は気中菌糸の發育がさかんで、菌糸は淡橙黄色 (Cadmium Yellow~Cadmium Orange) を呈し、菌叢上に少数の小さい柄胞子粘塊を生ずる。

*1 RIDGWAY, R: Color standard and nomenclature. (1912)

3. *Endothia havanensis* BRUNER (Text-fig. 3, Plate 2: C, D)

子座ははじめ樹皮内に生ずるが、のちほとんど表面にでる。散生または群生し表面は鮮橙黄色 (Zinc Orange)。子囊殻は子座の底部に不規則にうづまり、ふつう 10 個内外、球形部の直径は $290\sim440\mu$ 。子座の表面に孔口をひらく黒い頸をもち、頸の長さは $380\sim580\mu$ 。子囊はこん棒状ないし長紡錘形、大きさ $45\sim52\times5.5\sim7\mu$ 。子囊胞子は長橢円形ないし円筒形で両端はまるみをおびる。無色、2 胞、子囊のなかに 8 個が不規則に 2 列にならぶ。大きさ $8.5\sim11\times3\sim3.5\mu$ 。扇状菌糸は生じない。

BRUNER によればこの菌の子囊は $33\sim41\times5\sim7.5\mu$ 、子囊胞子は $7.5\sim9.5\times3\sim4\mu$ の大きさであり、子座ははじめ埋まつているのがちには表面にでる。著者らの菌は子囊が長い点をのぞけば BRUNER の記載によく一致する。*Eucalyptus globulus* は本菌のあたらしい寄主である。ジャガイモ寒天培養基に約 1 ヶ月培養した菌叢は黄褐色 (Deep Chrom) でまわりは白色を呈する。菌叢の中央部に小さい柄胞子の粘塊を多数生ずる。

4. *Endothia tropicalis* SHEAR et STEVENS (Text-fig. 4, Plate 3: A~D)

子座は樹皮に生じ、散生または群生、表面橙黄色 (Apricot Yellow~Cadmium Orange)。柄子殻は子座のなかに単一のあるいは数個の不規則形の小屋として生ずる。柄胞子は短桿形、無色、単胞、粘質をおび塊では淡黄色ないし橙黄色を呈する。大きさは $3.5\sim4\times0.5\sim1\mu$ 。子囊殻は子座の底部に不規則にかたまつて埋生し、ふつう 20 個内外を生ずる。球形部の直径は $260\sim540\mu$ 、子座の表面に孔口をひらく黒く長い頸をもち、その長さは $560\sim1410\mu$ 。子囊はこん棒状ないし長橢円形、大きさ $42\sim53\times5.5\sim8.5\mu$ 。子囊胞子は橢円形ないし円筒形で両端まるみをおび、無色、2 胞、隔膜部でくびれない。子囊のなかに 8 胞子が不規則に 2 列にならぶ。大きさ $8.5\sim12.5\times3\sim4\mu$ 、ふつう $10\sim11\times4\mu$ 。扇状菌糸は生じない。

SHEAR らによればこの菌の子囊は $40\sim50\times3\sim4\mu$ 、子囊胞子は $7.5\sim10.5\times3.5\sim5\mu$ の大きさをもつ。筆者らの菌は子囊胞子がややほそ長い点をのぞけば SHEAR らの記載した特徴によく一致し、同一菌と同定される。本菌の採集資料を Table 3 にしめたが、アペマキ、コナラ、シイおよびカシワはこの菌のあたらしい寄主である。ジャガイモ寒天培養基上に 1 ヶ月培養した菌は橙色 (Mikado Orange~Orange) の菌叢となり、表面に粘質の柄胞子塊を多数生ずる。

かつて原は SACCARDO の同定をえて *Endothia radicalis* (SCHW.) DE NOT. がわが国に存在することを数回にわたつてのべているが、現在この種名は SHEAR らによつて *Endothia fluens* (SCHW.) SHEAR et STEVENS とされ、そのおおくの異名のなかのひとつとなつてゐる。SACCARDO は *E. radicalis* (SCHW.) DE NOT. の子囊胞子の大きさを $7\sim9\times3\mu$ と記載し、これは *E. fluens* のはんいにはいる。しかし、原の記載した *E. radicalis* は子囊が $48\sim55\times8\sim9\mu$ 、子囊胞子が $10\sim12\times3\sim4\mu$ であり、*E. fluens* よりは大きくむしろ *E. tropicalis* によりちかい。筆者らはこの点をあきらかにするため科学博物館の小林義雄氏の好意をえて、同館に保存されてある原の採集した *E. radicalis* (SCHW.) DE NOT. のおおくの標本をしらべたが、この標本からはすでに子囊胞子がまつたくうしなわれており、これらの疑問をあきらかにすることはできなかった。

5. *Endothia parasitica* (MURR.) P. J. et H. W. ANDERSON (Text-fig. 5, Plate 4: A~F)

子座は樹皮に生じ、散生、群生または列生、表面黄褐色 (Cadmium Yellow~Cadmium Orange)。柄子殻は子座のなかに単一の、あるいは数個の不規則形の小屋として生ずるが、またしばしば材のうえに直

接子座をともしない小さい一室の柄子殻を生ずる。柄胞子は短桿形、無色、単胞、粘質をおび塊では黄色ないし橙黄色、大きさ $3\sim5.5\times0.5\sim1.5\mu$ 。子囊殻は子座の底部に不規則にかたまつて埋生し、ふつう 20~50 個を生ずる。球形部の直径は $210\sim410\mu$ 。子座の表面に孔口をひらく黒色の頸をもち、その長さは $360\sim1090\mu$ 。子囊はこん棒状ないし長橢円形、大きさ $36\sim55\times5\sim8.5\mu$ 、ふつう $42\sim50\times5.5\sim7\mu$ 。子囊胞子は橢円形、両端まるみをおびるかまたはわずかに尖がり、無色、2 胞、成熟すれば隔膜部でくびれる。子囊のなかに 8 個の子囊胞子が不規則 2 列にならぶ。大きさは $7\sim13\times3\sim5\mu$ 、ふつう $7\sim8.5\times3.5\sim4\mu$ 。ふつう樹皮の下に淡黄白色の扇状菌糸層を生ずる。

著者らの採集資料を Table 4 にしめた。これらのなかには個々にみると大きさにかんがりの変異のあるものがあるが、これらの菌は培養、扇状菌糸の存在、病原性などから *E. parasitica* と同定されたものである（このことをふくめて *E. parasitica* についてはのちに報告する予定である）。本菌の寄主にはクリのはかなら類、カエデ類など 5 科 7 属 31 種がしられているが、著者らの採集した標本は Table 4 にみられるように日本グリ、支那グリおよびその交配種のみであつた。ジャガイモ寒天培養基上に 1 カ月をへた菌叢は、ほぼたいらで橙黄色 (Cadmium Orange~Zinc Orange) を呈するが、ふちが白色を呈する菌株もある。ふつう菌叢表面に多数の小さい柄胞子の粘塊を生ずる。

6. *Endothia japonica* T. KOBAYASHI et K. ITO (Text-fig. 6, Plate 5: A, B)

子座は樹皮に生じ、散生または群生、表面黄褐色 (Deep Chrom~Cadmium Yellow)。子囊殻は子座の底部に不規則にかたまつて埋生し、ふつう 50 個ぐらいを生ずる。球形部の直径は $280\sim600\mu$ 。子座の表面に孔口をひらく黒く長い頸をもち、その長さは $480\sim1390\mu$ 。子囊は長こん棒状ないし長橢円形、大きさ $43\sim66\times7\sim11\mu$ 。子囊胞子は橢円形ないし倒卵形、無色、2 胞、成熟すれば隔膜部でくびれる。子囊のなかに 8 胞子が不規則 2 列にならぶ。大きさ $9\sim17\times3.5\sim5.5\mu$ 、ふつう $10.5\sim12.5\times4\sim4.5\mu$ 。扇状菌糸は生じない。

寄主：ミツナラ、コナラおよびクヌギ

分布：日本（本州）

資料：Table 6 にしめす。

記事：本菌はいままで知られている種のなかでは *Endothia tropicalis* にもつともちかいが、子囊および子囊胞子がそれよりも大きく、子囊胞子が隔膜部でくびれるなどの点で区別される。ジャガイモ寒天培養基において 1 カ月培養した菌叢はほぼたいらで、菌糸は橙色 (Orange~Cadmium Yellow) を呈し、菌叢表面に少数の柄子殻様体ができ、それから橙褐色の柄胞子粘塊を生ずる。

7. *Endothia macrospora* T. KOBAYASHI et K. ITO (Text-fig. 7, Plate 5: C~E)

子座は樹皮に生じ、散生または群生、表面鮮橙色 (Orange)。柄子殻は子座のなかに単一のあるいは数個の不規則形の小室として生ずる。柄胞子は短桿形、無色、単胞、粘質をおび、塊では黄色ないし橙色。子囊殻は子座の底部に不規則にかたまつて埋生し、ふつう 50 個ぐらいを生ずる。球形部の直径は $340\sim580\mu$ 。子座の表面に孔口をひらく黒く長い頸をもち、その長さは $790\sim1090\mu$ 。子囊は長こん棒状ないし長橢円形、大きさ $62\sim73\times10\sim11\mu$ 。子囊胞子は橢円形、無色、2 胞、隔膜部でくびれ、子囊のなかに 8 個が不規則 2 列にならぶ。大きさ $14\sim18\times5\sim5.5\mu$ の扇状菌糸は生じない。

寄主：シイ (22/VI '54, 東京都品川区——小林)

分布：日本（東京）

記事：本菌はいままでに知られているどの *Endothia* よりも、その子嚢および子嚢胞子がとびぬけて大きい。ジャガイモ寒天培養基上で1カ月をへた菌叢は桃白色ないし桃黄色（Bittersweet～Pinc ないし Salmon Orange）を呈し、ほぼたいらで菌叢上に2、3の大きい柄子殻を生じ、それから柄胞子の粘塊をおしだしている。

要 約

著者らはここ数年来 *Endothia* 属菌の採集につとめてきたが、現在までに7種の *Endothia* 菌をえた。このうち5種はいままでに知られている菌で、それぞれ *Endothia singularis* (P. et H. SYDOW) SHEAR et STEVENS, *E. fluens* (SCHW.) SHEAR et STEVENS, *E. havanensis* BRUNER, *E. tropicalis* SHEAR et STEVENS および *E. parasitica* (MURR.) P. J. et H. W. ANDERSON と同定された。2種のあたらしい菌は著者らによつて *Endothia japonica* および *E. macrospora* と命名された（正式のラテン記載文は日本植物病理学会報 21 巻4号——印刷中——にのせた）。

Notes on the Genus *Endothia* in Japan—I.
Species of *Endothia* collected in Japan.

Takao KOBAYASHI and Kazuo ITÔ

Introduction

In the genus *Endothia*, eight species including the chestnut blight fungus, *Endothia parasitica* (MURR.) P. J. et H. W. ANDERSON, have been known previously, so far as the writers are aware. In our country, however, a few reports on *Endothia parasitica* and its allies have been published and almost all of them have referred to the former.

In 1916, the first record of the occurrence of *Endothia parasitica* in Japan was made by SHEAR and STEVENS²³⁾ who examined the materials collected in Morioka and Nikkô. Thereafter, BOKURA³⁾, NANBU¹³⁾ and TSUJI²⁵⁾ noted the geographic distribution and pathogenicity of the fungus. HARA^{7,8,9)} gave some notes on *E. radicalis* (SCHW.) DE NOT. (this fungus, recorded by him, would belong to *E. tropicalis* SHEAR et STEVENS. See page 91). In 1927, KITAJIMA¹⁰⁾, who studied *E. parasitica* and two related species, published the result of a comparative work in morphology, pathogenicity and physiology of them without any taxonomical determinations on the relates.

In recent years, the writers have collected many specimens of *Endothia* inhabiting various kinds of broad-leaved trees and carried out the taxonomical study on these materials. The writers classified them into seven species, of which five were the known species and two were new. It is the purpose of the present paper to report the mycological reviews of these species with brief supplementary notes.

The writers wish to express their sincere thanks to Mr. Rokuya IMAZEKI, Chief of the Forest Protection Division, of the Government Forest Experiment Station, for his helpful suggestion and encouragement during the work. Their thanks are also extended to Mr. Yoshio KOBAYASHI, of the National Science Museum, for his courtesy in examining HARA's specimens preserved at the Museum, and to Mr. Michio NAKAGAWA for help in the preparation of the illustrations.

Species of *Endothia*

In various phases of research on some species of the genus *Endothia* established by FRIES in 1849, much complicated confusion was repeated by various workers until 1917 when SHEAR et al. published a monograph of the genus²⁴⁾. They rearranged them into six species after careful studies on a number of the specimens collected by the earlier investigators and by themselves. After the monograph was published, two other species were added by BRUNER and VIZIOLI. In Japan, there have been recorded three species, *E. parasitica*, *E. fluens*, and *E. radicalis* (See page 91). As mentioned above, the writers, however, have collected seven species of *Endothia*. Among them, five belong to known species, namely *E. singularis*, *E. fluens*, *E. havanensis*, *E. tropicalis* and *E. parasitica*, and the other two are new, to which the writers gave new names, *Endothia japonica* and *E. macrospora*. Thus, the genus *Endothia* contains now ten species as follows:

Section 1. Ascospores, 1-celled.

Endothia gyrosa (SCHW.) FRIES^{14,24)}

E. singularis (P. et H. SYDOW) SHEAR et STEVENS²⁴⁾

Section 2. Ascospores, 2-celled.

E. fluens (SCHW.) SHEAR et STEVENS²⁴⁾

E. havanensis BRUNER⁴⁾

E. Coccolobii VIZIOLI²⁶⁾

E. longirostris EARLE^{19, 24)}

E. tropicalis SHEAR et STEVENS²⁴⁾

E. parasitica (MURR.) P. J. et H. W. ANDERSON^{1, 2)}

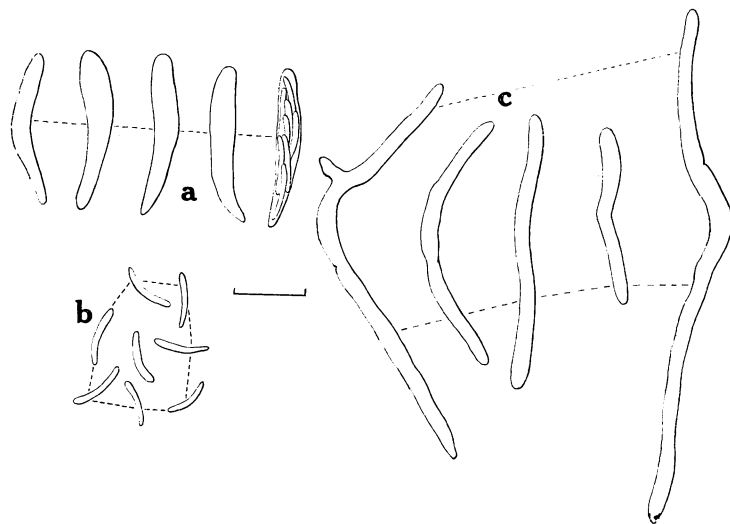
E. japonica T. KOBAYASHI et K. ITÔ¹²⁾

E. macrospora T. KOBAYASHI et K. ITÔ¹²⁾

In this paper, the morphology and some additional notes on Japanese *Endothia* are written in the order mentioned above.

1. *Endothia singularis* (P. et H. SYDOW) SHEAR et STEVENS (Text-fig. 1, Plate 1: A and B)

Stromata corticular, scattered or gregarious, reddish yellow to reddish brown (Cadmium Orange*¹ to Carmine or Naples Red); perithecia a few to many, usually 100 or more, irregularly arranged in several layers in the lower portion of the stroma, 200~350 μ in diam., with black slender necks which penetrate the stroma with 240~1010 μ length and open conical ostioles as papillae; asci subclavate or fusoid, slightly curved, 18~31 $\times$ 3~5.5 μ in size; ascospores unicellular, hyaline, cylindric or crescent, 5.5~11 $\times$ 0.7~1.7 μ , mostly 7~10 $\times$ 1.5 μ , in size; mycelial fans absent. New to Japan.



Text-fig. 1. *Endothia singularis* (P. et H. SYDOW) SHEAR et STEVENS
a: Asci and ascospores b: Ascospores c: Germinating ascospores (—=10 μ)

Host: Cut end of branches and dead trunks; *Shiia Sieboldii* MAKINO*² (Shii), *Quercus glandulifera* BL. (Ko-nara), *Q. acutissima* CARR. (Kunugi), *Q. gambelii* NUTTALL., *Q. leptophylla* RYDB., *Q. nitescens* RYDB., *Q. utahensis* RYDB. and *Q. pungens*.

Distribution: America and Japan (in Table 1)

*¹ Ridgway, R.: Color standard and nomenclature, (1912).

*² Host in Gothic is listed as a new host in the present paper.

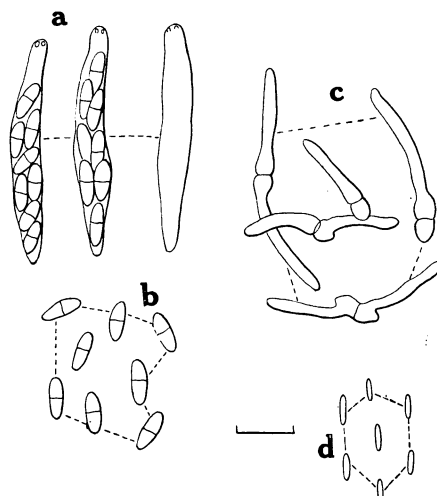
Table 1. Materials of *Endothia singularis*

No. of specimens	Host	Locality	Date of collection
ES—1	<i>Quercus glandulifera</i> BL. (Ko-nara)	Inagi, Tokyo	31/V '53
ES—2	<i>Shiia Siebordii</i> MAKINO (Shii)	Meguro, Tokyo	9/X '53
ES—3	"	"	13/X '53
ES—4	<i>Q. glandulifera</i> BL. (Ko-nara)	Machida, Tokyo	19/IV '54
ES—5	"	Misawa, Saitama Pref.	4/V '56
ES—6	"	Takai, Nagano Pref.	4/VI '56
ES—7	<i>Q. acutissima</i> CARR. (Kunugi)	"	"

Notes: In comparison with the original description by SHEAR et STEVENS, asci and ascospores of the writers' fungus are somewhat smaller than their fungus which has asci and ascospores of $25\sim35\times4.5\sim5.5\mu$ and $7\sim11\times1.5\sim3\mu$ in size, respectively. But the other characteristics quite agree with the description and, differences in size seem not so large as to separate them into different species. One month old cultures on potato-sucrose agar are flat and yellowish orange (Mikado Orange) in color, producing a few large viscosious conidial masses of Salmon Orange to Brazil Red color.

2. *Endothia fluens* (SCHW.) SHEAR et STEVENS (Text-fig. 2, Plate 1: C and D, and Plate 2: A and B)

Stromata corticular, scattered or gregarious, yellowish brown (Cadmium Yellow to Cadmium Orange); perithecia a few to many, usually 10 to 25, irregularly embedded in the lower portion of the stroma, $240\sim350\mu$ in diam., with black slender necks; necks $240\sim320\mu$ in length, opening conical ostioles at the surface of the stroma; asci clavate to fusoid, $30\sim40\times5.5\sim7\mu$ in size; ascospores irregularly biseriate, elliptic or cylindric, rounded at each end, hyaline, 2-celled, not constricted at septa, $6.5\sim8.5\times2.5\sim3.2\mu$ in size; pycnidia simple or more or less complex, irregularly chambered in the stroma and often appear on the wood as a simple small pycnidia without stroma; pycnosporos cylindric or rod-shaped, hyaline, continuous, viscosious, $4\times1\sim1.5\mu$ in size, and pale yellowish in mass; mycelial fans absent.

Text-fig. 2. *Endothia fluens* (SCHW.) SHEAR et STEVENS

a: Asci and ascospores b: Ascospores
c: Germinating ascospores d: Pycnosporos
(—=10 μ)

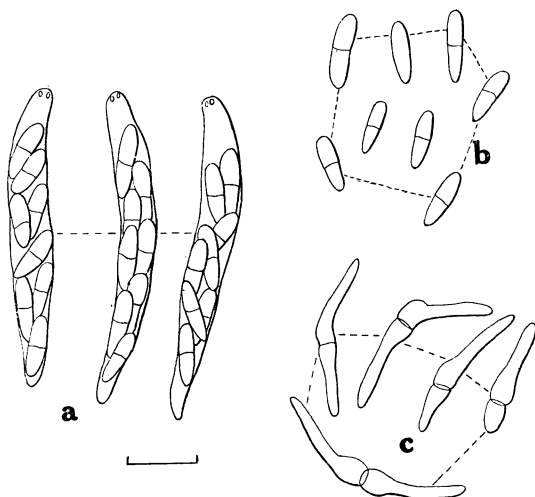
Host: Cut end of branches and stumps, and bark of dead trees; *Fagus japonica* MAX. (Buna), *Quercus glandulifera* BL. (Ko-nara), *Q. variabilis* BL. (Abemaki), *Q. alba* L., *Q. coccinea* MUENCH., *Q. marylandica* MUENCH., *Q. prinus* L., *Q. rubra* L., *Q. velutina* LAMARCK, *Q. pedunculata* EHRH., *Castanea dentata* BORKH., *C. sativa* GAERTN., *Alnus glutinosa* GAERTN., *Ulmus campestris* SM., *Carpinus betulus* L., *Corylus* sp. and *Shiia* sp.

Distribution: America, England, France, Germany, Switzerland, Italy, Transcaucasia and Japan (Table 2).

Table 2. Materials of *Endothia fluens*

No. of specimens	Host	Locality	Date of collection
EF—1	<i>Fagus japonica</i> MAX. (Buna)	Meguro, Tokyo	13/X '53
EF—2	<i>Quercus glandulifera</i> BL. (Ko-nara)	Machida, Tokyo	19/IV '54
EF—3	<i>Q. variabilis</i> BL. (Abemaki)	Meguro, Tokyo	26/VIII '54

Notes: These morphological characters quite agree with the SHEAR et al's description except that the writers' fungus has somewhat narrower ascospores. According to them the width of ascospores of the present species are $3\sim4.5\mu$. In one month old culture on potato-sucrose agar the mycelium has pale yellowish orange (Cadmium Yellow to Cadmium Orange) color with abundant aerial hyphae, and produces a few small pycnidia from which viscous conidial masses are pushed out.

Text-fig. 3. *Endothia havanensis* BRUNER

a: Asci and ascospores b: Ascospores

c: Germinating ascospores (— = 10μ)

hyaline, 2-celled, $8.5\sim11\times3\sim3.5\mu$ in size; mycelial fans absent. New to Japan.

Host: *Eucalyptus globulus* LAB. *E. occidentalis* ENDL., *E. botryoides* SM., *E. rostrata* SCHLECHT., *E. microphylla* WILLD., *E. robusta* SM., *Persea gratissima* GAERTN. f., *Mangifera indica* L. and *Spondias mombin* L.

Distribution: Havana, Cuba and Japan.

Material: On dead bark of *Eucalyptus globulus*, Meguro, Tokyo, Japan, Oct. 20, 1954.

Notes: According to BRUNER, the stromata of the present species are innate and then erumpent, and asci and ascospores are $33\sim41\times5\sim7.5\mu$ and $8.5\sim11\times3\sim3.5\mu$ in size, respectively. In Japanese fungus asci are a little longer, but other characteristics quite agree with the original description. One month old culture on potato-sucrose agar is orange (Deep Chrome) colored with white margin and bears small conidial masses at the central portion.

4. *Endothia tropicalis* SHEAR et STEVENS (Text-fig. 4, Plate 3: A~D)

Stromata corticular, scattered or gregarious, yellowish orange (Apricot Yellow to Cadmium Orange) colored on the surface; perithecia a few to many, usually 20 or more, irregularly embedded in the lower portion of the stroma, $260\sim540\mu$ in diam., with black slender necks; necks $560\sim1410\mu$ in length, opening conical ostioles at the surface of the

3. *Endothia havanensis* BRUNER (Text-fig. 3, Plate 2: C and D)

Stromata corticular, embedded when young and then erumpent, dark orange (Zinc Orange) on the surface; perithecia irregularly embedded in the lower portion of the stroma, $290\sim440\mu$ in diam.; necks black, slender and open conical ostioles as papillae through the stroma with $380\sim580\mu$ length; asci subclavate or oblong-fusoid, $45\sim52\times5.5\sim7\mu$ in size; ascospores irregularly biseriate, oblong-elliptic or cylindric, rounded at the ends,

stroma; asci clavate or oblong-elliptic, $42\sim53\times5.5\sim8.5\mu$ in size; ascospores irregularly biserial, elliptic or cylindric, rounded at each end, 2-celled, not constricted at septa, $8.5\sim12.5\times3\sim4\mu$, mostly $10\sim11\times4\mu$ in size; pycnidia simple or more or less complex, irregularly chambered in the stroma; pycnospores cylindric or rod-shaped, hyaline, viscous, pale yellowish or yellowish brown in mass, $3.5\sim4\times0.5\sim1\mu$ in size; mycelial fans absent. New to Japan.

Host: Bark of dead trees, cut end of branches and exposed roots; *Shiia Sieboldii* MAKINO (Shii), *Quercus variabilis* BL. (Abemaki), *Q. glandulifera* BL. (Ko-nara), *Q. dentata* THUMB. (Kashiwa) and *Elaeocarpus glandulifera*.

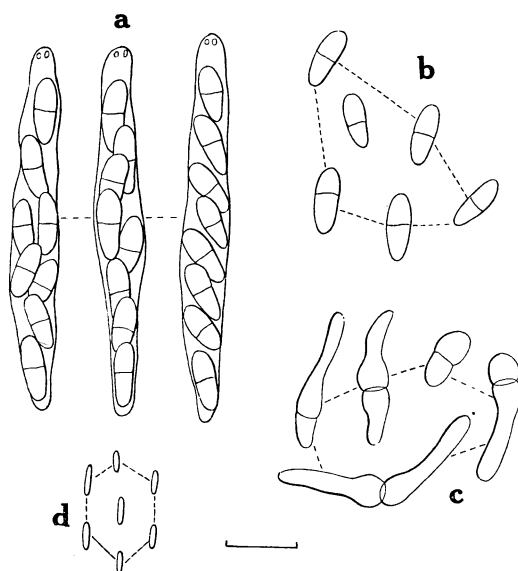
Distribution: Ceylon and Japan (Table 3).

Table 3. Materials of *Endothia tropicalis*

No. of specimens	Host	Locality	Date of collection
ET—1	<i>Quercus variabilis</i> BL. (Abemaki)	Seto, Aichi Pref.	22/X '53
ET—2	<i>Shiia Sieboldii</i> MAKINO (Shii)	Inagi, Tokyo	2/XII '53
ET—3	<i>Q. glandulifera</i> BL. (Ko-nara)	Ueno, Chiba Pref.	14/VI '54
ET—4	"	Konitahara, Chiba Pref.	14/VI '54
ET—5	<i>Q. dentata</i> THUMB. (Kashiwa)	Minami-maki, Nagano Pref.	16/X '55
ET—6	<i>Q. glandulifera</i> BL. (Ko-nara)	Mt, Otome, Shizuoka Pref.	14/V '56

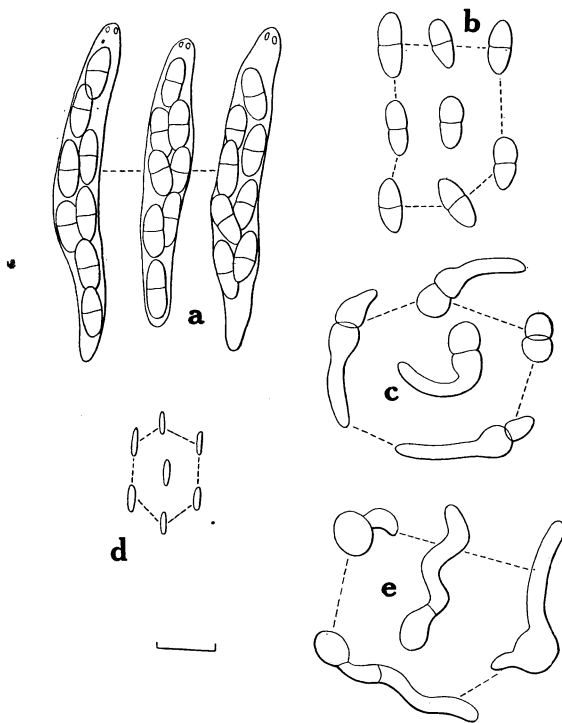
Notes: The writers' fungus has somewhat wider asci and longer ascospores than the original which was measured respectively as $40\sim50\times7\mu$ on asci and $7.5\sim10.5\times3.5\sim5\mu$ on ascospores, but these differences are in a specific range so that they are classified as the same as *E. tropicalis*. One month old culture on potato-sucrose agar is orange (Mikado Orange to Orange) colored and viscous conidial masses are irregularly produced on the surface of the colony.

HARA^{7,8,9)} recorded the occurrence of *E. radicalis* (SCHW.) DE NOT. from Japan on several occasions, based on SACCARDO's agreement. The name, however, is usually regarded as a synonym of *E. fluens* (SCHW.) SHEAR et STEVENS²⁴⁾. According to SACCARDO¹⁴⁾, the size of ascospores of *E. radicalis* sense SACCARDO is $7\sim9\times3\mu$, which is similar to *E. fluens*, whereas HARA recorded his *E. radicalis* as follows: $48\sim55\times8\sim9\mu$ on asci and $10\sim12\times3\sim4\mu$ on ascospores. This shows that the fungus should be referred to as *E. tropicalis* rather than *E. fluens*. For the purpose of settling this question the writers examined



Text-fig.4. *Endothia tropicalis* SHEAR et STEVENS

a: Asci and ascospores b: Ascospores
c: Germinating ascospores d: Pycnospores
(—=10 μ)



Text-fig. 5. *Endothia parasitica* (MURR.) P. J. et H. W. ANDERSON

- a: Asci and ascospores b: Ascospores
c: Germinating ascospores d: Pycnospores
e: Germinating pycnospores (—=10 μ)

line, 2-celled, constricted at septum when mature, 7~14 $\times$ 3~5 μ , mostly 7~8.5 $\times$ 3.5~4 μ ; pycnidia simple or more or less complex, irregularly chambered in the stroma; pycnospores bacilloid or rod-shaped, hyaline, unicellular, viscosious, pale yellowish to yellowish orange in mass, 3~5.5 $\times$ 0.5~1.5 μ ; pale yellowish colored mycelial fans are usually formed under the bark.

Host: *Castanea dentata* BORKH., *C. sativa* MILL., *C. crenata* S. et Z., *C. mollissima* BL., *C. henryi* REHD. et WILS., *C. seguinii* KODE, *C. ozarkensis* ASHE, *C. pumila* MILL., *C. alabamensis* ASHE, *C. alnifolia* NUTT., *C. floridana* (SANG.) ASHE, *C. margaretta* ASHE, *Castanopsis chrysophylla* DE CAND., *Quercus alba* L., *Q. coccinea* MUENCH., *Q. ilex* L., *Q. petraea* (MATT.) L. et L., *Q. pedunculata* EHRH., *Q. prinus* L., *Q. pubescens* WILL., *Q. robur* L., *Q. rubra* L., *Q. sessilifolia* SM., *Q. stellata* WANG., *Q. velutina* LAM., *Acer palmatum* THUMB., *A. saccharum* MARSH., *A. rubrum* L., *Carya ovata* K. KOCH, *Rhus typhina* L. and *Ostrya virginiana* KOCH.

Distribution: America, Canada, Italy, France, Switzerland, Spain, Portugal, Yugoslavia, India, China, Korea and Japan.

Materials: Collections in our country are shown in Table 4.

Notes: Some materials among the specimens given in Table 4, have considerable variation in size of asci and ascospores, but they are identified with the present species by the presence of mycelial fan, cultural characters, the pathogenicity on chestnut and

HARA's specimens preserved at the National Science Museum of Japan, but could not find any spores because of empty perithecia of the specimens.

5. *Endothia parasitica* (MURR.)

P. J. et H. W. ANDERSON (Text-fig. 5, Plate 4: A~F)

Stromata usually corticular, scattered on the smooth bark and often confluent on the old bark, yellowish to brownish orange (Cadmium Yellow to Cadmium Orange) colored; perithecia a few to many, usually 20 to 50, irregularly embedded in the lower portion of the stroma, 210~410 μ in diam., with black slender necks which penetrate the stroma with 360~1090 μ length and open conical ostioles at the surface of the stroma; asci sub-clavate or oblong-elliptic, 36~55 $\times$ 5~8.5 μ , mostly 42~50 $\times$ 5.5~7 μ ; ascospores elliptic, rounded or slightly acute at the ends, hyaline,

Table 4. Materials of *Endothia parasitica*

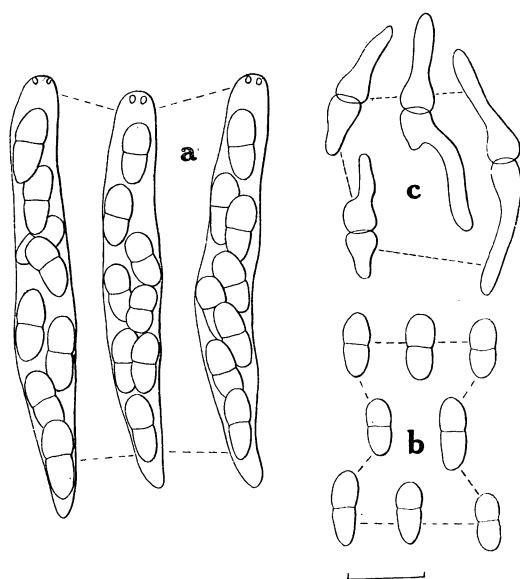
No. of specimen	Host		Locality	Date of collection
	Species	Name of variety		
EP—1	<i>Castanea mollissima</i> Bl.	Nakai-shina	Yamazaki, Hyogo Pref.	10/I '50
EP—2	<i>C. crenata</i> S. te Z.		Akanuma, Saitama Pref.	25/X '51
EP—3	"	Shiba ²⁾	Inagi, Tokyo	31/V '53
EP—4	"	"	Minakami, Shizuoka Pref.	4/VI '53
EP—5	<i>Cm</i> × <i>Cc</i> ? ¹⁾	"	Meguro, Tokyo	22/VI '53
EP—6	<i>C. crenata</i> S. te Z.		Matsudo, Chiba Pref.	9/VII '53
EP—7	"	Sekino-wase	Koganei, Tokyo	2/IX '53
EP—8	"	"	"	"
EP—9	"	Kappa	"	"
EP—10	"	Shiba	Asakawa, Tokyo	16/IX '53
EP—11	"	Sekino-wase	Tsurukawa, Tokyo	18/IX '53
EP—12	"	Gosha	"	"
EP—13	"	Gan-ne	"	"
EP—14	"	Shimo-Katsugi	"	"
EP—15	"	"	"	"
EP—16	"	Gin-Yose	Yokohama, Kanagawa Pref.	28/IX '53
EP—17	"	Gan-ne	"	"
EP—18	"	Taisho-wase	"	"
EP—19	"	Osaya	"	"
EP—20	"	Nakate-Tamba	Kawasaki Kanagawa Pref.	"
EP—21	"	Shiba	Akanuma, Saitama Pref.	16/X '53
EP—22	"	"	"	"
EP—23	"	Kasahara-wase	"	"
EP—24	"	Shōgatsu	"	"
EP—25	"	Taisho-wase	"	"
EP—26	"	Chōkōji	"	"
EP—27	"	Ban-aka	"	"
EP—28	"	Suzu-nari	"	"
EP—29	"	Ka no tsume	"	"
EP—30	"	Gan-ne	"	"
EP—31	"	Kasahara-wase	"	"
EP—32	<i>C. mollissima</i> Bl.		"	"
EP—33	"		"	"
EP—34	<i>C. crenata</i> S. et Z.	Shiba	Seto, Aichi Pref.	21/X '53
EP—35	"	Aka-chū	"	"
EP—36	"		"	"
EP—37	"	Shiba	Seki, Gifu Pref.	23/X '53
EP—38	"	Ichi-emon	"	"
EP—39	"	Dai-hachi	"	"
EP—40	"	"	"	"
EP—41	"	Gin-yose	"	"
EP—42	<i>C. mollissima</i> Bl.		"	"
EP—43	<i>C. crenata</i> S. et Z.	Shiba	Machida, Tokyo	19/IV '54
EP—44	"	"	Ueno, Chiba Pref.	14/VI '54
EP—45	<i>C. mollissima</i> Bl.	Hino-haru	Meguro, Tokyo	23/VI '54
EP—46	<i>C. crenata</i> S. et Z.	Shiba	Higashine, Yamagata Pref.	7/VIII '54.

1) F₁ hybrid of Chinese chestnut × Japanese chestnut, but detailed data were not preserved.

2) Shiba is generally calling to wild species of Japanese chestnut.

others^{*1}. In one month old cultures on potato-sucrose agar the fungous colonies are flat, yellowish orange (Cadmium Orange to Zinc Orange) colored with whitish margin and usually produce numerous conidial masses.

*1 Details on the present fungus will be reported in the future.



Text-fig. 6. *Endothia japonica* T. KOBAYASHI
et K. ITÔ.

a: Asci and ascospores b: Ascospores

c: Germinating ascospores (—=10μ)

mycelial fans absents.

Host: Cut end of branches and bark of dead trees; *Quercus grosseserrata* BL. (Mizu-nara), *Q. glandulifera* BL. (Ko-nara) and *Q. acutissima* CARR. (Kunugi).

Distribution: Japan (Honshū) (Table 5)

Table 5. Materials of *Endothia japonica*

No. of specimens	Host	Locality	Date of collection
EJ— 1	<i>Quercus grosseserrata</i> BL. (Mizu-nara)	Meguro, Tokyo	19/V '54
EJ— 2	"	Mt. Ōtake, Tokyo	23/V '54
EJ— 3	"	Mt. Togakushi, Nagano Pref.	18/VII '54
EJ— 4	"	Higashine, Yamagata Pref.	6/VIII '54
EJ— 5	"	Mt. Zaō, Yamagata Pref.	7/VIII '54
EJ— 6	"	Narusawa, Yamanashi Pref.	23/IX '54
EJ— 7	<i>Q. glandulifera</i> BL. (Ko-nara)	Kanō, Nagano Pref.	24/X '54
EJ— 8	"	Hinoharu, Yamanashi Pref.	19/IV '55
EJ— 9	<i>Q. grosseserrata</i> BL. (Mizu-nara)	Akasawa, Nagano Pref.	11/X '55
EJ—10	"	Wada, Nagano Pref.	13/X '55
EJ—11	<i>Q. acutissima</i> CARR. (Kunugi)	Takai, Nagano Pref.	4/VI '56

Notes: The present species is very near in type to *Endothia tropicalis* among the already known species. In *E. tropicalis*, asci are $40\sim50\times7\mu$ and ascospores are $7.5\sim10.5\times3.5\sim5\mu$, mostly $8\sim10\times4\sim4.5\mu$, whereas the writers' fungus has longer asci and ascospores than the latter as mentioned above, distinguishing both sufficiently to classify them into

*1 The Latin diagnosis was described in Ann. Phytopath. Soc. Japan, 21 (4), (1956).

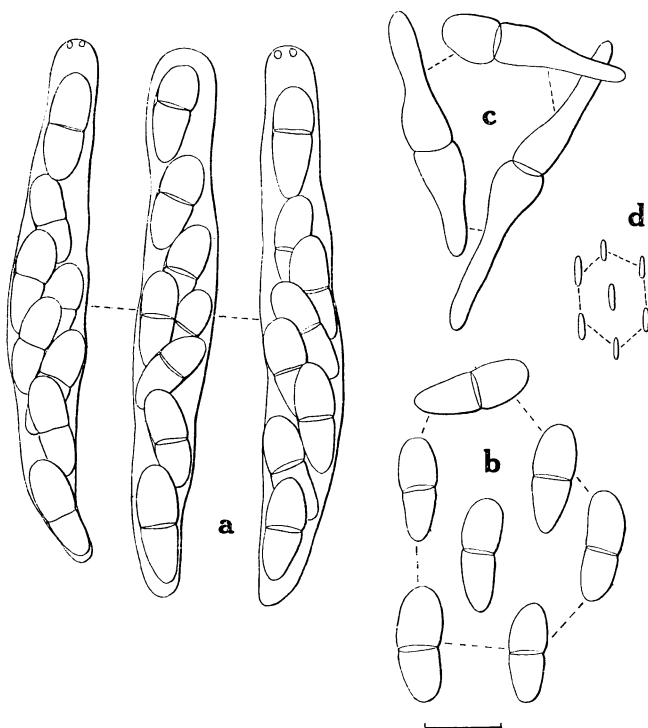
6. *Endothia japonica* T. KOBAYASHI et K. ITÔ*1 (Text-fig. 6, Plate 5: A and B)

Stromata corticular, scattered or gregarious, yellowish orange (Deep Chrome to Cadmium Yellow) colored on the surface; perithecia a few to many, usually 50 or more, irregularly embedded in the lower portion of the stroma, $280\sim600\mu$ in diam., with black slender necks; necks are $480\sim1390\mu$ in length and open conical ostioles at the surface of the stroma; asci subclavate or oblong-elliptic, $43\sim66\times7\sim11\mu$; ascospores irregularly biserial or rarely uniserial, elliptic or obovoid, hyaline, 2-celled, constricted at septa when mature, $9\sim17\times3.5\sim5.5\mu$, mostly $10.5\sim12.5\times4\sim4.5\mu$;

different species. Moreover, ascospores of the present fungus are constantly constricted at septum when mature. In one month old culture on potato-sucrose agar the fungus grows flatly and has yellowish orange (Orange to Cadmium Yellow) colored mycelium, on which a few pycnidial bodies are produced.

7. *Endothia macrospora* T. KOBAYASHI et K. ITO*¹ (Text-fig. 7, Plate 5: C, E)

Stromata corticular, scattered or gregarious, Orange colored on the surface; perithecia a few to many, usually 50 or more, irregularly embedded in the lower portion of the stroma, 340~580 μ in diam., with black slender necks which penetrate the stroma with 790~1090 μ length and open conical ostioles at the surface of the stroma; asci oblong-subclavate to oblong-elliptic, 62~73 $\times$ 10~11 μ ; ascospores irregularly biserial, elliptic, hyaline, 2-celled, constricted at septa, 14~18 $\times$ 5~5.5 μ ; pycnidia simple or more or less complex, irregularly chambered in the stroma; pycnosporos rod-shaped, unicellular, hyaline, viscous, 3.5~4.5 $\times$ 0.7~1.1 μ ; pale yellow in mass; mycelial fan absent.



Text-fig. 7. *Endothia macrospora* T. KOBAYASHI et K. ITO.

a: Asci and ascospores b: Ascospores

c: Germinating ascospores d: Pycnosporos.

(—=10 μ)

Host: On the bark of dead *Shiia Sieboldii* MAKINO (Shinagawa, Tokyo, June 22, 1954).

Distribution: Japan (Tokyo).

Notes: In this species asci and ascospores are far larger than those of all the other species of the genus. One month old cultures on potato-sucrose agar are flat and have pinkish yellow (Bittersweet or Pink to Salmon Orange) colored mycelium, on which the viscous conidial masses are pushed out from a few large pycnidia.

Summary

The writers collected seven species of *Endothia* in Japan and described their mycological review with supplementary notes. Five of them are hitherto known species, namely *Endothia singularis* (P. et H. SYDOW) SHEAR et STEVENS, *E. fluens* (SCHW.) SHEAR et STEVENS, *E. havanensis* BRUNER, *E. tropicalis* SHEAR et STEVENS and *E. parasitica* (MURR.)

*¹ The Latin diagnosis was described in Ann. Phytopath. Soc. Japan, 21(4), (1955).

P. J. et H. W. ANDERSON, and the other two are introduced under the name of *Endothia japonica* and *E. macrospora* by the writers, respectively.

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Explanation of plates

Plate 1. A and B: *Endothia singularis* (P. et H. SYDOW) SHEAR et STEVENS

A: Stromata on the cut end of the branch of *Quercus glandulifera* BL. $\times 1.2$,

B: Perithecia $\times 240$.

C and D: *Endothia fluens* (SCHW.) SHEAR et STEVENS

C: Stromata on the stump of *Quercus glandulifera* $\times 1$,

D: Sporehorns on *Q. variabilis* BL. $\times 1$.

Plate 2. A and B: *Endothia fluens* (continued)

A: Perithecia $\times 240$, B: Pycnidia $\times 310$.

C and D: *Endothia havanensis* BRUNER

C: Stromata on the bark of dead *Eucalyptus globulus* BAB. $\times 1$, D: Perithecia $\times 240$.

Plate 3. *Endothia tropicalis* SHEAR et STEVENS

A: Stromata on the dead branch of *Quercus variabilis* $\times 1.5$, B: Stromata on the dead bark of *Shiia Siebordii* MAKINO $\times 1.5$, C: Stromata on the exposed roots of *Q. glandulifera* $\times 1.2$, D: Perithecia $\times 240$.

Plate 4. *Endothia parasitica* (MURR.) P. J. et H. W. ANDERSON

A: Stromata on the stem of 2-year-old tree of *Castanea crenata* SIEB. et ZUCC. (Sekinowase) $\times 1$, B: Stromata on the dead trunk of *C. mollissima* BL. (Hinoharu) $\times 1.5$,

C: Mycelial fans formed under the bark of *C. crenata* (wild species) $\times 2$, D: Sporehorns on *C. crenata* (Kappa) $\times 2$, E: Perithecia $\times 240$, F: Pycnidia $\times 310$.

Plate 5. A and B: *Endothia japonica* T. KOBAYASHI et K. ITÔ

A: Stromata on *Quercus grosseserrata* BL. $\times 1.5$, B: Perithecia $\times 180$.

C—E: *Endothia microspora* T. KOBAYASHI et K. ITÔ

C: Stromata on dead trunk of *Shiia Siebordii* $\times 1.5$, D: Sporehorns on *S. Siebordii* $\times 2$, E: Perithecia $\times 180$.

